INSULATION PACKAGE ARRANGEMENT FOR INSULATING THE INTERIOR OF AN AIRCRAFT FUSELAGE

CROSS REFERENCE TO RELATED APPLICATIONS

The present application claims priority of DE 10 2004 001 049 filed January 05, 2004 and US 60/600,106 filed August 09, 2004, which are both hereby incorporated by reference.

FIELD OF THE INVENTION

The invention relates to an insulation for an aircraft such as a fire insulation or protection. In particular, the present invention relates to an insulation package arrangement for insulating the interior of an aircraft fuselage.

BACKGROUND OF THE INVENTION

Conventional insulation systems are known which, as shown in the enclosed Fig. 1, essentially comprise a core- and insulation material which is embedded in an insulation package and comprise an enclosure. The core- and insulation material may comprise products of the fiber industry, of which products in particular glass fiber materials (glass wool) are in widespread use. This material meets to a very large extent the requirements regarding thermal and acoustic insulation. In order to install (attach) the relatively amorphous semi-finished products to (or near) the vehicles structure, the insulation package (which is made from these semi-finished products) is enclosed in an enclosing foil. The ends of this enclosing foil may be reinforced so that adequate attachment of the (thus completed) insulation package to the structural surfaces of the vehicle can take place by means of attachment elements.

In aircraft engineering, attachment of insulation packages takes place on the ribs of the fuselage structure, wherein attachment elements are used which usually comprise a plastic material, for example a polyamide.

Fig. 2, shows a so-called post-crash fire scenario of an aircraft where burning kerosene can cause the aluminum cell of the aircraft structure and also the fuselage insulation (interior insulation) of the aircraft to burn through. Trough such holes, a flashback of the fire into the passenger cabin may occur. Thus, there is always a

desire to provide for an even better fire insulation or protection for aircraft fuselages which may withstand such fire situations for an extended period of time.

Furthermore, conventional insulation attachment elements are made from non-metal materials (plastics), which in the case of a fire may melt. Thus, there is always a desire to extend a period of time the attachment elements resist a fire and hold the insulation in place to prevent falling down of the (burning) insulation (insulation packages), which may lead to the presence of uncontrollable obstacles the vehicle's interior.

In addition to this, WO 00/75012 A1 discloses an aircraft fuselage insulation which is stated to be "fire-resistant". This printed publication discloses an insulation package which, is arranged as primary insulation within a space situated between the interior paneling of the fuselage and the outer skin of the fuselage. In this arrangement, the insulation package is protected in regions by a foil made of a fire-blocking material, wherein this foil region which acts in a fire-blocking way directly faces the outer skin of the fuselage (in the manner of a protective shield against fire).

SUMMARY OF THE INVENTION

According to an exemplary embodiment of the present invention, an insulation package suitable for arrangement in a space between an interior paneling of an aircraft cabin and an outer skin of the aircraft, and a respective arrangement are provided, comprising a first insulation package of a first type and a second insulation package of a second type. According to an aspect of the present invention, the first insulation package of the first type and the second insulation package of the second type are combined to a third insulation package of a third type.

It is believed that due to the combination of the first and second insulation packages, an amount of section points between the first and second insulation packages may be reduced which may allow for an improved insulation since these section points or section lines often represent weak points of the insulation.

E.g., the first insulation package of the first type may be a insulation package for a rib or frame region of the fuselage whereas the second insulation package of the second type may be an insulation package for a field region of the fuselage. The types of the insulation packages may differ by dimensions such as thickness, size, by the material of the insulation package or by a foil and/or the material or layering of the foil which at least partially may envelope the insulation packages.

Furthermore, burn-through-proof attachment elements may be used for arranging and/or attaching the third insulation package to structures of the vehicle, such as frames, ribs or stringers of the fuselage. Such burn-through-proof attachment elements may comprise metal, but may also be made of fire resistant material such as a plastic having a high melting point. Also, the insulation packages may me arranged such that the packages themselves also protect the attachment element from the exposure to the fire. This may e.g. realized by arranging the insulation package such that it forms a cushion around the attachment element or forms a kind of fire shield.

It is believed that an improved insulation package arrangement for an aircraft may be provided, which arrangement may be used for interior insulation, to such an extent that with it the flames of a seat of fire acting from outside the aircraft environment are essentially prevented from entering the cabin space of an aircraft (that has made an emergency landing) or a fire withstanding time may be extended. The design of the insulation package and its attachment to the fuselage structure is believed to be suitable for implementing an increase in the fire protection safety of separated interior regions that are situated near a structural outer skin.

An insulation package arrangement according to an exemplary embodiment of the present invention may prevent the spread of flames acting from outside the aircraft environment, of a source of fire, from entering the cabin space of the aircraft, wherein the design and attachment of an insulation package on the fuselage structure is implemented in such a way that the cabin region of the aircraft is protected against fire spreading from outside the aircraft environment. Furthermore, it is believed that

evacuation of the passengers from the vehicle is clearly facilitated e.g. due to the fact that the time required until the fasteners give up may be extended.

BRIEF DESCRIPTION OF DRAWINGS

An exemplary embodiment of the invention is described in more detail with reference to the following drawings.

Fig. 1 shows conventional fuselage insulation in a commercial plane;

Fig. 2 shows a (so-called) post-crash fire scenario relating to an aircraft about to park;

Fig. 3 shows an insulation package arrangement for insulating the interior of an aircraft fuselage with a burn-through-proof foil enclosure of the insulation package according to an exemplary embodiment of the present invention;

Fig. 4 detail "x" shown in Fig. 4, shows the attachment of the insulation end sections of two fuselage insulation packages on a rib according to an exemplary embodiment of the present invention;

Fig. 5 shows a view of a first attachment element in the form of an insulation pin according to an exemplary embodiment of the present invention;

Fig. 5a shows a longitudinal section view of the insulation pin shown in Fig. 5;

Fig. 6 shows a lateral view of a second attachment element in the form of a cage body in the form of a truncated cone according to an exemplary embodiment of the present invention;

Fig. 6a shows a top view of the cage body in the form of the truncated cone shown in Fig. 6 according to an exemplary embodiment of the present invention;

Fig. 7 shows a structure holder, attached to a stringer, comprising riveted attachment of the insulation sections of the fuselage insulation packages according to an exemplary embodiment of the present invention;

Fig. 7a shows the attachment of the insulation sections on a rib head with an extended rib according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

For greater ease of understanding Fig. 1, which shows an insulation, it should be mentioned by way of an introduction that the structural unit of the aircraft fuselage not only comprises stringers 31 with which all the panels of an outer skin 33 of an aircraft fuselage structure are stiffened, but also comprises several ribs 32 which are arranged perpendicular to the longitudinal axis 9 of the aircraft (approximately) at a distance c, and are attached to the stringer 31. Integrated in these ribs 32, on the unattached end is a (so-called) rib carrier 40 which continues on parallel to the longitudinal axis 9 of the aircraft, wherein the (unattached free) end of the rib carrier 40 (according to this embodiment) is angled perpendicular to the longitudinal axis 9 of the aircraft.

Fig. 1 shows the position of an insulation package 3 (with general reference characters) (of the fuselage insulation) on the (near) outer skin 33 of the aircraft. In each instance this insulation package 3 comprises a so-called field insulation package 17 and a so-called rib insulation package 16, which in the traditional way are both installed separately and are attached near the outer skin 33 or are attached so as to rest against a stringer support surface 31a of the stringer 31 (i.e. in a defined structural zone of the aircraft fuselage structure). Fig. 1 thus shows that a field insulation package 17 has been placed between the (two) ribs 32, spaced apart at a distance c, near (resting against) an inner area of a panel of the outer skin of the outer skin 33. Furthermore, a rib insulation package 16 has been placed onto the rib carrier 40, wherein said rib insulation package 16 is guided so as to be resting on both sides against the longitudinal sides 41 of the ribs. When viewed from the side as shown in Fig. 3, the rib insulation package 16 is guided not only on the so-called front longitudinal side 41 (the right-hand side) of the rib but also on the so-called rear longitudinal side 41 (the left-hand side) of the rib.

These two insulation packages are completely enclosed by a combustible plastic foil. They are arranged within a space (not shown in Fig. 1) delimited by interior cladding of the aircraft and the panels of the outer skin 33.

The insulation arrangement according to an exemplary embodiment of the present invention may be arranged in spaces, e.g. in spaces to be partitioned off, which spaces include a space enclosed by the outer skin 33 and by interior cladding of the aircraft cabin, said space being arranged parallel at a defined distance (transversely to the longitudinal axis of the fuselage 9).

With reference to Fig. 2 “a fire situation” involving an aircraft after an emergency landing will be described. If, in the context of such a (hypothetical) fire situation, referred to as a “post-crash fire scenario“ 7, one considers that an emergency situation for passengers and the aircrew will arise in the fuselage, i.e. in the interior of the cabin in the case of an aircraft structure 8 (damaged from the outside) (with a defective outer skin 33) following external mechanical action and a resulting fire acting on the shown aircraft regions due to spillage and ignition of kerosene, then it may be understood that a period of time during which the structure, the fuselage and also the paneling withstands the fire should be extended and as long as possible to allow e.g. a coordinated evacuation.

Below, respective improvements and exemplary embodiments are proposed with which that an improved protection may be provided. It will, among others, be referred to Fig. 3 and subsequently Figures 4, 4a, 5, 5a and 6.

In order to implement this aspect, which intends to provide better fire protection safety for separated interior space regions (cabin regions), for example of a passenger aircraft, which interior space regions are situated near the outer skin 33 of the aircraft, it should be mentioned at this point that a burn-through-proof foil 11 made of a fireproof foil material is proposed which according to the embodiment shown in Fig. 3 completely encloses a fuselage insulation package 19 which is used for insulating the interior of an aircraft fuselage. A foil material which is only fire

resistant or fire retarding may not be sufficient in all cases. It is believed that by providing a complete foil enclosure of the fuselage insulation package 19 on its own, it may not always be possible to counter the impending hazards in a (non-foreseeable and non-desired) case of a catastrophic fire involving an aircraft – for whatever reasons – in order to meet the threatening hazards of a catastrophic fire.

Fig. 3 shows an advanced fuselage insulation system. The arrangement of the fuselage insulation on the structure of an aircraft fuselage is shown, which arrangement comprises several fuselage insulation packages 19, 20, 21, 22 arranged in the direction of the longitudinal axis 9 of the aircraft, wherein the packages are of an elongated shape.

An individual fuselage-insulation package 19 to 22 comprises a combined field insulation package and rib insulation package 17, 18 (presented with regard to Fig. 1), in each instance relating to a fuselage insulation package 19 to 22 whose arrangement on the structure of the aircraft fuselage to the largest extent possible agrees with the position of the individual field- and rib insulation package 17, 18 according to Fig. 1. As a result of this combination, the frequency of the joints (interruptions) (shown in Fig. 1) in the fuselage insulation is minimized or reduced (in comparison with the traditional installation of such insulation packages 3), at least halved, which, from the point of view of fire protection safety, in the region of the attachment points of the fuselage insulation presents fewer weak points to the fire.

In contrast to the field- and rib insulation packages 17, 18 where only relatively amorphous semi-finished products, for example glass fiber materials, are used which meet the requirements of thermal and acoustic insulation, which insulation is enclosed by a combustible plastic foil, the design of individually proposed fuselage insulation packages 19 to 22 takes into account a burn-through proof insulation of a larger cross section, or a burn-through-proof barrier layer of a smaller cross section, or both burn-through-proof insulation means, which are thus arranged either individually (each on its own) or together in combination within the respective fuselage insulation package 19 to 22.

In this arrangement one of the two burn-through-proof insulation means is situated either close to or resting against an interior wall region of the foil wall (of the foil 11).

As an alternative it is imaginable for the burn-through-proof insulation or the barrier layer to be guided outside of and adjacent to the circumference of the foil 11 of the individual fuselage insulation package 19 to 22, which insulation or barrier layer is attached to a support area 31a of the stringer 31 and is attached to the circumference of the foil 11 by means of adhesive connections.

Fig. 4, which will be explained in more detail later, shows a detail "x" which is shown in Fig. 3. Clearly shown is burn-through-proof insulation with a cross section which is larger than that of a barrier layer, wherein said insulation is arranged within the respective fuselage insulation package 19 to 22 and on the end of the foil 11 exits the latter as a flat insulation end section 12 (with the thickness of the burn-through-proof foil). The technology relating to sealing the foil end at the exit point of the insulation section 12 is not dealt with in detail.

This flat insulation end section 12, which continues, lengthwise outward, from the individual fuselage insulation package 19 to 22 which is elongated in shape, will be used for end-side attachment of the fuselage insulation packages 19 to 22 to the respective stringer 32a, 32b, 32c, wherein the attachment will be explained with reference to Fig. 4.

Fig. 3 also shows that for example a first fuselage insulation package 20 is arranged so as to rest against a support area 31a of the (respective) stringer 31 between a (thus numbered) third rib 32c and a first rib 32a, which are spaced apart by a specified distance c.

Fig. 3 further shows that the front and back of this first fuselage insulation package 20 are attached sideways in relation to (both) longitudinal sides 41a, 41b of the rib of

a so-called first rib 32a, whose exiting insulation section 12 together with that of a second fuselage insulation package 21 (mentioned below) is attached to the first rib 32a (as shown in Fig. 4).

Likewise – using the same technology – the second fuselage insulation package 21 is arranged so as to rest against the support area 31a of the stringer 31 between the first rib 32a and a second rib 32b, which are spaced apart by said specified distance c, whose exiting insulation section 12 together with that of a fourth fuselage insulation package 22 (mentioned below and numbered accordingly) is attached to the second rib 32b (as shown in Fig. 4).

Additionally – using the technology described – a third fuselage insulation package 19 is arranged so as to rest against the support area 31a of the (respective) stringer 31 between the mentioned third rib 32c and a rib which is spaced apart from and arranged in front of the latter by the distance c, whose exiting insulation section 12 together with that of the first fuselage insulation package 2 is attached to the third rib 32c (as shown in Fig. 4). Furthermore, the placing of a fourth fuselage insulation package 22 is shown whose exiting insulation section 12 together with that of the second fuselage insulation package 21 is attached to the second rib 32b (as shown in Fig. 4).

For attachment, burn-through-proof attachment elements 4, 13 are used whose shape and design are shown in Figures 5, 5a, 6, 6a and whose arrangement (in conjunction with the image of the way the exiting insulation sections 12 are attached to the ribs 32a to 32c) is shown in Fig. 4.

In addition to the above explanations it should be mentioned that an embodiment which relates to placing of one of the fuselage insulation packages 19 to 22, which could rest against an inner area of a panel of the outer skin, is not examined in more detail although such a placement would theoretically also be imaginable. To this extent it is only mentioned that placement of the individual fuselage insulation packages below the intended stringer support area 31a and situated on the outer skin

33 will take place in a way similar to the placement in the installation explained above. If necessary, attachment could be on the given longitudinal sides 41a, 41b of an individual rib.

Fig. 4 shows the attachment of the first and second fuselage insulation package 20, 21 to the first rib 32a, wherein this embodiment of attachment, as has already been suggested, is technologically applied to the same extent on all ribs 32a, 32b, 32c (up to an nth rib) arranged in the direction of the longitudinal axis 9 of the aircraft, with two fuselage insulation packages 20, 21 which rest in series on the stringer support surface 31a, which rest on the rib-delimiting stringer support surface 31a. A prerequisite of this was that (in the context of previous work) a through hole 24 was drilled in the rib attachment region 15.

Furthermore, in a defined package region of the individual fuselage insulation package 19 to 22, which package region is provided for the rib to rest against the rear- (lateral right) positioned first longitudinal side 41a of the (in this instance) first rib 32a, a so-called hole-like leadthrough has been formed.

The package region arranged downstream of the respective fuselage insulation package 19 to 22 which (as shown in Fig. 1) rests against the rib carrier 40, and laterally resting against the angled-off end of the rib carrier 40, on the end of the foil end continues to a first flat insulation end section 12a of the (for example first) fuselage insulation package 20, which insulation end section 12a on the other side (lateral left) rests against a second longitudinal side 41b of the first rib 32a, which longitudinal side 41b is positioned on the front. Said first flat end section of insulation 12a comprises a so-called hole-like recess. Since it is intended for a second flat insulation end section 12b – which is continued on the end of the foil at the end of the adjacent (serially arranged) second fuselage insulation package 21 – to be arranged on or below the support surface of the first insulation section 12a, that insulation end section 12b also comprises a so-called hole-like recess. If the hole-like leadthrough, the through hole and those two hole-like recesses are arranged so as to be congruent, an insulation pin, which is burn-through-proof, of the first attachment

element can be fed through the holes of that defined package region of the first fuselage insulation package 20, through the through hole of the rib attachment region 15 and through the attachment region of the two flat insulation sections 12a, 12b.

According to Figures 5, 5a, the design of the insulation pin is implemented with a cylindrical core element 25 and a cylinder-like plastic-like casing 28, wherein the core element 25 near the end of the pin 27 in each case comprises a flange-like elevation 26. The core element 25, whose shape is shown in the longitudinal section view according to Fig. 5a, is embedded in that plastic-like casing 28. Approximately in the middle of the casing 28, a (type of ring-) flange 29 exits, from which, starting at the cylindrical circumference of the casing 28 and parallel to a pin axis 43 of the first attachment element 4 (of the insulation pin) distributed along its length – several pine-tree-shaped elevations 30 are positioned, which are arranged so as to be spaced apart from each other at a distance a. The pine-tree-shaped elevations 30 are comparable to a type of stepped gradation 44 that is conical, wherein the gradation 44 starts at the circumference of the casing 28, wherein its tapering off conical form is realized by a conical tapering off of the circumference of the casing. The end region of the casing 28 is dome-shaped, in the form of a recess. The external shape of said end region is similar to that of a paraboloid, comparable to the shape of a parabolic rotation body whose longitudinal section has been realized with a parabolic shape, wherein the branch end of the parabola is continued by a stepped gradation 44 drawn inward vertically in relation to the pin axis 43. The core element 25 is made from metal, namely a steel, preferably stainless steel. In contrast to this, the casing is made from a plastic of poor thermal conductivity.

The design of the second attachment element 13 is implemented according to Figures 6, 6a with a so-called truncated-cone body in the form of a cage body in the shape of a truncated cone. The base area and cover area 46, 47 are implemented with insulation discs or ring elements which are designed so as to be burn-through proof. At the external circumference of these insulation discs or ring elements there is an insulation jacket 50, designed to be burn-through proof, which on the rim side is

mechanically connected to the element of the base area and to the element of the cover area.

The truncated-cone body could be designed such that the cover area 46 comprises a first insulation disc, where a hole has been made in the middle of the disc. The diameter of this hole should be smaller than the external diameter of the end region 42, in the shape of a paraboloid, of the dome-shaped casing 28, so that the holed wall of this insulation disc made from a plastic material can be guided with a tight fit over the branch end of the parabola of the parabolic end region 42 of the casing 28. Without pre-empting the further explanations, it is intended that the first insulation disc, made from a plastic material, due to the admitted flexibility of the plastic material can be moved over the dome-shaped casing 28 of the first attachment element 4 of the insulation pin (with a tight fit), whereas in the opposite direction of movement, this insulation disc can only be guided over the dome-shaped casing 28 with considerable mechanical effort. Since this embodiment will also take into account a second insulation disc made of a plastic material, which disc forms the base area 46 of the truncated-cone body, in which in the middle of the disc there is a hole, the diameter of this hole is the same as, or slightly larger than, the external diameter of said dome-shaped casing 28 of the first attachment element 4 of the insulation pin, so that said second insulation disc can be fitted over that dome-shaped casing 28 of the insulation pin. Returning to the illustrations in Figures 3 and 4 it thus becomes clear that in the final analysis a second attachment element 13, designed in such a way, of the flat insulation end sections 12, 12a, 12b to be fixed and attached to the longitudinal sides 41, 41a, 41b of the ribs 32, 32a, 32b, 32c is likely to be suitable.

As an alternative a second attachment element 18, designed as a truncated-cone body, comprising a first plastic-like insulation ring 48 of a larger circumference and a second plastic-like insulation ring 49 of a smaller circumference, is implemented. In this design, the circumference of the first insulation ring 48 edges the cover area 47 of the truncated-cone body of said second attachment element 13, whereas the circumference of the second insulation ring 49 edges the base area 46 of the

truncated-cone body of said second attachment element 13. It is imaginable that on the interior ring diameter of the first and the second insulation ring 48, 49, several insulation braces 51, spaced apart on the circumference, are attached in vertical position. However, it may be sufficient if these insulation braces only the circumference of the second insulation ring 49 with the external circumference of a disc-shaped core element 52, wherein the external diameter of the core element 52 may be (significantly) smaller than the interior ring diameter of the second insulation ring 49. The core element 52 and the second insulation ring 49 are situated flat in the same plane, wherein the core element 52 comprises a hole in the centre of the disc and is embedded in a plastic-like casing.

It should be noted that the hole diameter of the second insulation ring 49 may be smaller than the external diameter of the end region 42, implemented in the shape of a paraboloid, of the dome-shaped casing 48, namely for the reasons mentioned above in regard to the above embodiment of the hole of the first insulation disc. The disc-shaped cone element 42 is made from metal. It comprises a steel, preferably stainless steel.

The above-mentioned casing of the core element 2 is implemented using a plastic material of poor thermal conductivity.

For the sake of completeness, it should be mentioned that the insulation discs and the insulation rings from which the second attachment element 13 is constructed, are arranged so as to be parallel in relation to each other, wherein the element which forms the base area 46, in other words the second insulation ring 49, is arranged at a ring distance b (height distance of the rings) from the element which forms the cover area 47, in other words the first insulation ring 48. The circumference of these elements is enclosed by that insulation jacket 50 which is attached to the outside circumference of the rings.

It should be added that the second attachment element 13 can also be compared to the shape of a cage body in the form of a so-called truncated-cone body, because

several insulation braces 51, designed so as to be burn-through proof, can be joined on the margin of the base area and cover area 46, 47 of said second attachment element 13. In this arrangement, the insulation braces 51 which are distributed around the circumference are attached on the circumference of the second insulation ring 49 which has the larger circumference and to the first insulation ring 48, which braces 51 support the two rings in a cage-like manner. As an alternative it would be imaginable that these insulation braces 51 are supported by a second insulation disc (which forms the base area 46) and by a first insulation disc (which forms the cover area 47), to which the ends of the insulation braces 51 are attached by the rim.

It should also be mentioned that several fuselage insulation packages 19 to 22, which are positioned in a region of the fuselage structure which is delimited by ribs 32, 32a, 32b, 32c, are arranged on the inner structure of the fuselage. In this arrangement it is envisaged that the hole-like recess of the flat insulation end sections 12, 12a, 12b of those (at least two) fuselage insulation packages 19 to 22 which on one longitudinal side 41, 41a, 41b of the rib 32 32a, 32b, 32c continue in an insulation section are conveyed to the first attachment element 4, which is an insulation pin designed to be burn-through-proof. As a result of this, a so-called overlap of the insulation end sections 12, 12a, 12b is formed on the respective longitudinal sides 41, 41a, 41b, 41c of the respective ribs. The attachment of said insulation end sections 12, 12a, 12b on the longitudinal sides 41, 41a, 41b, 41c of the ribs to the first attachment element (4) is secured with the second attachment element 13, which is an insulation disc or ring element).

Finally, Fig. 7 shows a structure holder 53 which is joined to a stringer 31, attached to the outer skin 33 (and if need be) adjacent to the contact surface of the respective stringer attachment. However, this structure holder 53 can also be attached to the rib 32, 32a, 32b, 32c or to the unattached end of a rib 32, 32a, 32b, 32c at the (extended) rib head. This illustration shows that it is quite possible to attach those flat insulation end sections 12, 12a, 12b which extend a fuselage insulation package 19 to 22 between the support surfaces of the structure holder 53 and a support element (angled in the illustration shown) by riveting or screwing the element arrangement with a

further burn-through-proof attachment element. That further attachment element is provided by a rivet, comprising steel or titanium, or by a screw and nut, comprising steel or titanium or plastic. The screw connection element can comprise aramide or a CFK material.

Fig. 7a shows that rivet connection or that attachment of the insulation end sections 12, 12a, 12b on the rib-extended structure holder 53 which is attached to that rib head of the rib 32, 32a, 32b, 32c (which rib head is made without a rib carrier 40) by means of a screw connection on the rib-extended free end of the respective rib 32, 32a, 32b, 32c with said burn-through-proof connection element.

These measures according to Figures 7 and 7a ensure that in this arrangement in the area of system precautions which relate to the structure holder 53 riveted or screwed onto the structure, flashback of the flames of a fire (entering from outside the aircraft environment) is prevented. In this arrangement, this so-called “fire barrier” between these precautions and the aircraft structure is screwed or riveted.

In conclusion, it should be noted that the fuselage insulation package which is considered in relation to Fig. 1 is still an insulation package 3 traditionally made of glass fibers (glass wool). In this arrangement the core material of said insulation package 3 only meets the requirements of thermal and acoustic insulation.

(Here too) these are mostly products of the fiber industry, wherein predominantly glass fiber materials are used. Due to a (clearly) existing fire hazard for a passenger (or passengers) and aircrew as a result of this conventionally used design of the insulation package 3, in future improvements of said insulation package 3 will be necessary. This will have become clear with reference to the example shown in Fig. 2.

In order to at least halfway meet fire protection safety as far as the overall arrangement of interior insulation of an aircraft fuselage is concerned, the fuselage insulation packages 19 to 22 (up to an nth package) mentioned in Fig. 3, the core

material (the glass fibers) will be completely enclosed by the above-mentioned foil 11 which is designed to be burn-through proof. The foil 11, which is proposed for enclosing the respective fuselage insulation package 19 to 22, is implemented with the use of a material that is burn-through proof, in other words with a foil material which does not succumb to fire coming through due to the extended effect of the flames of a fire 7 (shown in Fig. 2) acting on the outside surface of the foil 11, or on the foil material. This foil material will be an absolute barrier to a flaming fire to which a surface area of this foil 11 is exposed during a catastrophic fire which is e.g. shown in Fig. 2.

Since the term "burn-through proof" very much correlates to "fireproof", wherein "fireproof" is synonymous with "resistant to fire", the foil 11 will therefore comprise a material of significant long-term fireproofness, with said material having adequate fire resistance. The degree of resistance to fire 7 correlates to the type of foil material used and the thickness of the foil wall, wherein the duration of resistance correlates to a time span in which the foil 11 is used, which is regarded as a very long time span, which will last for a (finite) period starting with the commencement of the use of the foil 11, for example until a point in time at which the foil material for reasons of foil aging will lose its resistance to fire 7, or where it can be expected that such resistance to fire 7 will decrease.

The term "insensitive" describes a state of "not being sensitive" (in this instance) to the effect which exposure to flames of the fire 7 has on the foil material. Since other sensitivities of the foil material, for example to the environmental conditions which act on the foil material from outside the insulation package 3 at the location where the foil 11 is used, are imaginable, the statement "burn-through proof" will primarily include the statement "insensitive" to fire 7, wherein the foil material used is really also (and in aircraft engineering should also be) insensitive to other influences, for example to pollution and other chemical influences in the air, to the influence of electrical hazards, and to the influence of ambient barometric pressure etc.

Accordingly, the foils 11 should therefore be implemented with a material of very considerable and long lasting fireproofness, which material is resistant to and/or insensitive to fire 7 being encountered, for which reason there will be no burning through of a foil wall as a result of the influence of the flaming fire 7, even during extended influence on the foil surface area, and spreading of the fire 7 licking the foil surface area may be prevented.